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CONSERVATIVE TREATMENT OF TRACHEAL RUPTURE

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A 75-year-old man, who had a history of colorectal carcinoma, hypertension, obesity, and diabetes mellitus, was referred to our intensive care unit (ICU) for assessment and treatment of acute respiratory failure and extensive subcutaneous emphysema. Three days before, he underwent elective abdominal surgery (colorectal carcinoma) in another institution. Intubation and surgery were uneventful. Six hours postoperatively, the patient had the development of subcutaneous cervical emphysema. This emphysema extended during the next 2 days and pneumomediastinum and right pneumothorax were disclosed on chest radiographs. Despite placement of a tube in the right side of the chest, the respiratory status of the patient rapidly deteriorated and he was transferred to our ICU on day 3.

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On admission the patient was experiencing acute respiratory failure and giant subcutaneous emphysema (head, neck, and thorax). Auscultation revealed crackling crepitus and bilaterally decreased breath sounds. Abdominal examination showed partial evisceration. The chest radiograph showed massive pneumomediastinum and right partial pneumothorax. A right chest tube was placed anteriorly at the level of the third intercostal space and drainage of the subcutaneous emphysema was attempted through multiple dermohypodermal thoracic incisions. He was intubated and mechanical ventilation was started. General anesthesia, analgesia, and paralysis were produced by continuous intravenous infusion of midazolam (0.1 mg/kg per hour), fentanyl (2μg/kg per hour), and pancuronium bromide (0.02 mg/kg per hour). Piperacillin-tazobactam (12 g/d) and ciprofloxacin (400 mg/d) were started as antibiotics. Abdominal contention was applied externally with the means of a Contensor (B. Braun Fandre SA, Ludres, France). Blood gas levels under mechanical ventilation (FiO_2, 0.35) were PaO_2 103 mm Hg, $PaCO_2$ 42 mm Hg, and pH 7.37. Biologic data revealed anemia (hematocrit, 23%; hemoglobin, 7.6 g/dL) without leukocytosis and acute renal failure (blood urea nitrogen 20.8 mmol/L; creatinine 177 mmol/L). Further diagnostic work-up of this postoperative respiratory failure included chest computed tomography, which showed extensive pneumomediastinum (Fig 1), and fiberoptic bronchoscopy, which revealed

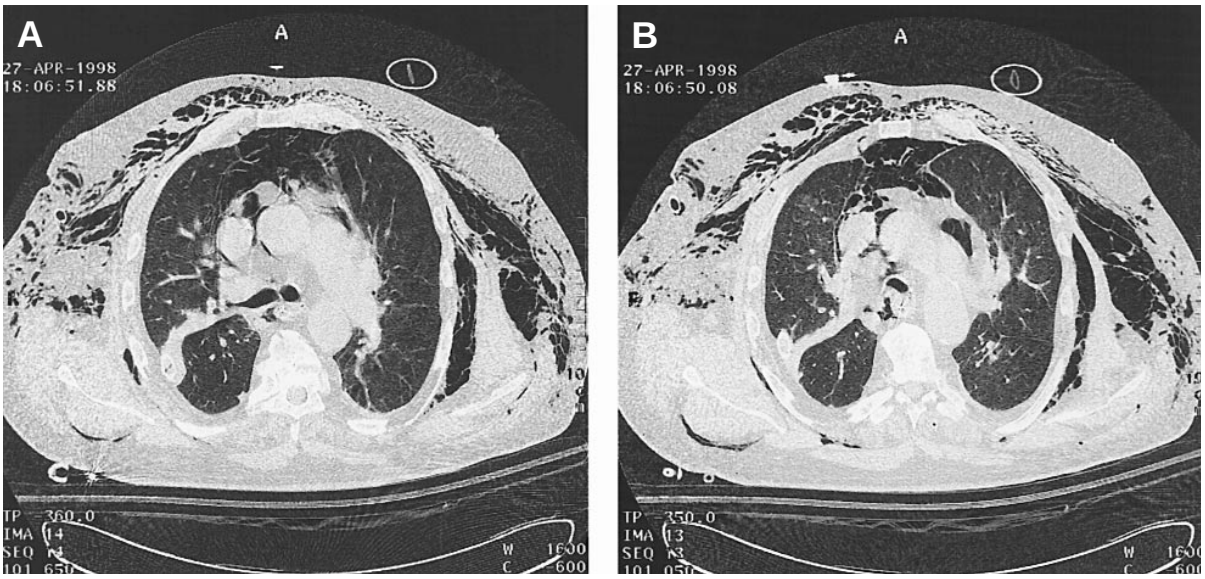

Fig 1. Chest computed tomography at the level of the main carina (**A**) and 10 mm upward (**B**), just at the level of the tracheal rupture.

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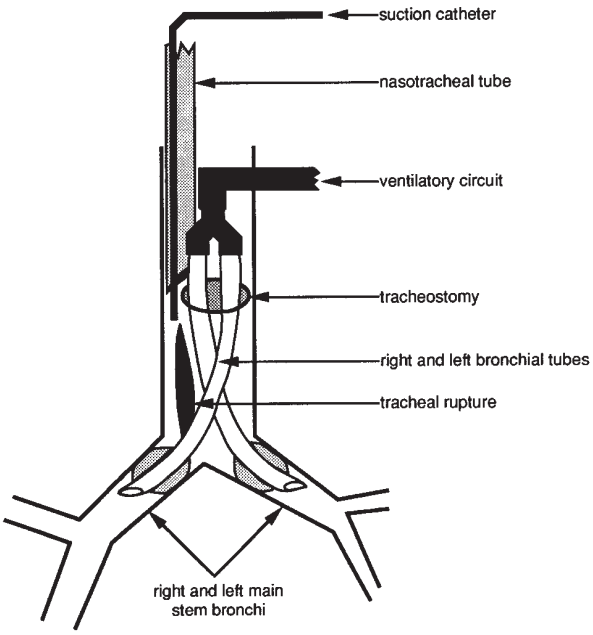

Fig 2. Schematic view of the tracheal exclusion procedure.

a 4-cm long laceration of the posterior wall of the trachea, starting at the level of the carina. At this time, surgical repair of this tracheal rupture was postponed because the vital signs and respiratory status were stable and the operative risk was estimated to be too high because of age and comorbidities (hypertension, obesity, diabetes, recent major abdominal operation, evisceration, and renal failure).

Three days later (day 6 after the operation) vital signs were stable, but the respiratory status clearly deteriorated. Despite optimization of the ventilation parameters, sufficient minute ventilation could no longer be achieved because of the importance of the air leak, which was absent at the level of the right chest tube. The chest radiograph confirmed the absence of right pneumothorax but showed persisting massive pneumomediastinum. Fiberoptic bronchoscopy showed that the tracheal tear had extended approximately 10 mm upward and that positive-pressure ventilation (PPV) resulted in frank widening of the tracheal wound and concomitant air leakage through the dermohypodermal thoracic incisions during each respiratory cycle. Because of the high operative risk we decided to attempt "tracheal exclusion" to obtain efficient PPV without air shunting through the tracheal wound. This was achieved by cannulating the right and the left main stem bronchi by 6 mm high-volume low-pressure cuffed tubes (Fig 2). Each cuff was gently inflated to obtain only a minimal intermittent air leak during each respiratory cycle. To ensure maximal stability of bronchial cannulation, these tubes were inserted through a large cervical tracheotomy (third tracheal ring interspace). The tubes were connected to the ventilator through a Y piece. An 8-mm nasotracheal tube was also inserted (without inflation of the cuff), with the tip positioned above the level of the tracheotomy. This tube served first as security in case of sudden obstruction of the "tracheobronchial device" (which would then have been immediately retrieved while the nasotracheal tube would have been pushed down). The nasotracheal tube also served as an access for continuous suctioning with a 7F catheter to prevent the accumulation of oropharyngeal secretions in the trachea above the bronchial cuffs. Under these circumstances satisfactory ventilation could be achieved (tidal volume, 650 mL; frequency, 15; peak inspiratory pressure, <30 cm H_2O; P plateau, <30 cm H_2O). Air leakage through the dermohypodermal thoracic incisions immediately stopped, and subcutaneous emphysema resolved within 5 days. The patient remained on ventilation therapy for 16 days. During this period, daily fiberoptic bronchoscopy was performed to clear bronchial secretions and to check the correct positioning of the tracheobronchial tubes. A survey of the tracheal rupture was not possible because of the position of the tubes. On day 22 after the operation, renal function had returned to normal, and abdominal evisceration had nearly completely healed. Bronchoscopic examination of the posterior tracheal wall was performed after removal of the tracheobronchial tubes and showed complete sealing of the tracheal rupture. The trachea was then cannulated with a conventional tracheostomy tube, and sedation was discontinued. Weaning from the ventilator and tracheal decannulation were obtained, respectively, 3 and 6 days later. The patient was discharged from the ICU 32 days after the operation, with complete healing of his tracheal wound.

Discussion. Tracheobronchial rupture either iatrogenic (after intubation) or traumatic (after blunt trauma) usually requires aggressive management.[1-3] In some cases, especially when the patient is receiving spontaneous ventilation therapy, even large tracheal defects can uneventfully recover under conservative treatment.[4] On the opposite, in cases of massive air leak with respiratory failure requiring mechanical ventilation, surgical repair of the tracheobronchial rupture is mandatory. In the present case, progressive enlargment of the tracheal rupture with concomitant worsening of the respiratory status despite correct pleural drainage prompted us to consider aggressive management. Thoracic operations, however, entailed a severe risk before and after the operation because of the severe underlying conditions. Selective right and left bronchial intubation allowed us to apply PPV while shunting the trachea and thereby the tracheal rupture. Continuous tracheal suctioning and antibiotics were instituted to prevent nosocomial respiratory infection and mediastinitis. Bronchoscopic survey of the tracheal rupture was impossible because of the presence of the tracheobronchial tubes in the lower trachea. We therefore decided to wait for a usual healing time before removing the tracheobronchial tubes and performing bronchoscopic examination of the trachea. Meanwhile, mechanical ventilation and sedation allowed progressive healing of abdominal evisceration. Fortunately, this prolonged period of mechanical ventilation was not complicated by nosocomial infection.

This case shows the potential for "spontaneous" healing of tracheobronchial ruptures as soon as PPV is not applied at

the level of the tracheobronchial wound. Although surgical repair must be considered first in transmural tracheal ruptures requiring mechanical ventilation, the conservative "tracheal exclusion technique" reported herein may be an alternative to surgical repair when the patient cannot undergo an operation.

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